### Section 11: Contract-Holder Behavior Assumptions

A. General

Contract-holder behavior assumptions encompass actions such as lapses, withdrawals, transfers, recurring deposits, benefit utilization, option election, etc. Contract-holder behavior is difficult to predict accurately, and variance in behavior assumptions can significantly affect the results. In the absence of relevant and fully credible empirical data, the company should set behavior assumptions as guided by Principle 3 in Section 1.B.

In setting behavior assumptions, the company should examine, but not be limited by, the following considerations:

1. Behavior can vary by product, market, distribution channel, fund performance, time/product duration, etc.
2. Options embedded in the product may affect behavior.
3. Utilization of options may be elective or non-elective in nature. Living benefits often are elective, and death benefit options are generally non-elective.
4. Elective contract-holder options may be more driven by economic conditions than non-elective options.
5. As the value of a product option increases, there is an increased likelihood that contract holders will behave in a manner that maximizes their financial interest (e.g., lower lapses, higher benefit utilization, etc.).
6. Behavior formulas may have both rational and irrational components (irrational behavior is defined as situations where some contract holders may not always act in their best financial interest). The rational component should be dynamic but the concept of rationality need not be interpreted in strict financial terms and might change over time in response to observed trends in contract-holder behavior based on increased or decreased financial efficiency in exercising their contractual options.
7. Options that are ancillary to the primary product features may not be significant drivers of behavior. Whether an option is ancillary to the primary product features depends on many things such as:

a. For what purpose was the product purchased?

b. Is the option elective or non-elective?

c. Is the value of the option well-known?

1. External influences, may affect behavior.

B. Aggregate vs. Individual Margins

1. Prudent estimate assumptions are developed by applying a margin for uncertainty to the anticipated experience assumption. The issue of whether the level of the margin applied to the anticipated experience assumption is determined in aggregate or independently for each and every behavior assumption is discussed in Principle 3 in Section 1.B, which states:

2. The choice of a conservative estimate for each assumption may result in a distorted measure of the total risk. Conceptually, the choice of assumptions and the modeling decisions should be made so that the final result approximates what would be obtained for the Stochastic reserve at the required CTE level if it were possible to calculate results over the joint distribution of all future outcomes. In applying this concept to the actual calculation of the Stochastic reserve, the actuary should be guided by evolving practice and expanding knowledge base in the measurement and management of risk.

3. Although this principle discusses the concept of determining the level of margins in aggregate, it notes that the application of this concept shall be guided by evolving practice and expanding knowledge. From a practical standpoint, it may not always be possible to completely apply this concept to determine the level of margins in aggregate for all behavior assumptions.

4. Therefore, the company shall determine prudent estimate assumptions independently for each behavior (e.g., mortality lapses and benefit utilization), using the requirements and guidance in this section and throughout these requirements, unless the company can demonstrate that an appropriate method was used to determine the level of margin in aggregate for two or more behaviors.

C. Sensitivity Testing

The impact of behavior can vary by product, time period, etc. Sensitivity testing of assumptions is required and shall be more complex than, for example, base lapse assumption minus 1% across all contracts. A more appropriate sensitivity test in this example might be to devise parameters in a dynamic lapse formula to reflect more out-of-the-money contracts lapsing and/or more holders of in-the-money contracts persisting and eventually using the guarantee. The company should apply more caution in setting assumptions for behaviors where testing suggests that stochastic modeling results are sensitive to small changes in such assumptions. For such sensitive behaviors, the company shall use higher margins when the underlying experience is less than fully relevant and credible.

D. Specific Considerations and Requirements

1. Within materiality considerations, the actuary should consider all relevant forms of contract-holder behavior and persistency, including, but not limited to, the following:

1. Mortality (additional guidance and requirements regarding mortality is contained in Section 12).
2. Surrenders.
3. Partial withdrawals (systematic and elective).
4. Fund transfers (switching/exchanges).
5. Resets/ratchets of the guaranteed amounts (automatic and elective).
6. Future deposits.

2. It may be acceptable to ignore certain items that might otherwise be explicitly modeled in an ideal world, particularly if the inclusion of such items reduces the calculated provisions. For example:

a. The impact of fund transfers (intra-contract fund “switching”) might be ignored, unless required under the terms of the contract (e.g., automatic asset re-allocation/rebalancing, dollar cost averaging accounts, etc.).

b. Future deposits might be excluded from the model, unless required by the terms of the contracts under consideration and then only in such cases where future premiums can reasonably be anticipated (e.g., with respect to timing and amount).

3. However, the company should exercise caution in assuming that current behavior will be indefinitely maintained. For example, it might be appropriate to test the impact of a shifting asset mix and/or consider future deposits to the extent they can reasonably be anticipated and increase the calculated amounts.

4. Normally, the underlying model assumptions would differ according to the attributes of the contract being valued. This would typically mean that contract-holder behavior and persistency may be expected to vary according to such characteristics as (this is not an exhaustive list):

1. Gender.
2. Attained age.
3. Issue age.
4. Contract duration.
5. Time to maturity.
6. Tax status.
7. Fund value.
8. Investment option.
9. Guaranteed benefit amounts.
10. Surrender charges, transaction fees or other contract charges.
11. Distribution channel.

5. Unless there is clear evidence to the contrary, behavior assumptions should be no less conservative than past experience. Margins for contract-holder behavior assumptions shall assume, without relevant and credible experience or clear evidence to the contrary, that contract-holders’ efficiency will increase over time.

6. In determining contract-holder behavior assumptions, the company shall use actual experience data directly applicable to the business segment (i.e., direct data) if it is available. In the absence of direct data, the company should then look to use data from a segment that is similar to the business segment (i.e., other than direct experience), whether or not the segment is directly written by the company. If data from a similar business segment are used, the assumption shall be adjusted to reflect differences between the two segments. Margins shall reflect the data uncertainty associated with using data from a similar but not identical business segment. .

7. Where relevant and fully credible empirical data do not exist for a given contract-holder behavior assumption, the company shall set the contract-holder behavior assumption to reflect the increased uncertainty such that the contract-holder behavior assumption is shifted towards the conservative end of the plausible range of expected experience that serves to increase the aggregate reserve. If there are no relevant data, the company shall set the contract-holder behavior assumption to reflect the increased uncertainty such that the contract-holder behavior assumption is at the conservative end of the range. Such adjustments shall be consistent with the definition of prudent estimate, with the principles described in Section 1.B., and with the guidance and requirements in this section.

8. Ideally, contract-holder behavior would be modeled dynamically according to the simulated economic environment and/or other conditions. It is important to note, however, that contract-holder behavior should neither assume that all contract holders act with 100% efficiency in a financially rational manner nor assume that contract holders will always act irrationally. These extreme assumptions may be used for modeling efficiency if the result is conservative.

E. Dynamic Assumptions

1. Consistent with the concept of prudent estimate assumptions described earlier, the liability model should incorporate margins for uncertainty for all risk factors that are not dynamic (i.e., the non-scenario tested assumptions) and are assumed not to vary according to the financial interest of the contract holder.
2. The company should exercise care in using static assumptions when it would be more natural and reasonable to use a dynamic model or other scenario-dependent formulation for behavior. With due regard to considerations of materiality and practicality, the use of dynamic models is encouraged, but not mandatory. Risk factors that are not scenario tested, but could reasonably be expected to vary according to a stochastic process, or future states of the world (especially in response to economic drivers) may require higher margins and/or signal a need for higher margins for certain other assumptions.
3. Risk factors that are modeled dynamically should encompass the plausible range of behavior consistent with the economic scenarios and other variables in the model, including the non-scenario tested assumptions. The company shall test the sensitivity of results to understand the materiality of making alternate assumptions and follow the guidance discussed above on setting assumptions for sensitive behaviors.

F. Consistency with the CTE Level

1. All behaviors (i.e., dynamic, formulaic and non-scenario tested) should be consistent with the scenarios used in the CTE calculations (generally, the top 30% of the loss distribution). To maintain such consistency, it is not necessary to iterate (i.e., successive runs of the model) in order to determine exactly which scenario results are included in the CTE measure. Rather, in light of the products being valued, the company should be mindful of the general characteristics of those scenarios likely to represent the tail of the loss distribution and consequently use prudent estimate assumptions for behavior that are reasonable and appropriate in such scenarios. For variable annuities, these “valuation” scenarios would typically display one or more of the following attributes:
2. Declining and/or volatile separate account asset values.
3. Market index volatility, price gaps and/or liquidity constraints.
4. Rapidly changing interest rates.

2. The behavior assumptions should be logical and consistent both individually and in aggregate, especially in the scenarios that govern the results. In other words, the company should not set behavior assumptions in isolation, but give due consideration to other elements of the model. The interdependence of assumptions (particularly those governing customer behaviors) makes this task difficult and by definition requires professional judgment, but it is important that the model risk factors and assumptions:

1. Remain logically and internally consistent across the scenarios tested.
2. Represent plausible outcomes.
3. Lead to appropriate, but not excessive, asset requirements.

4. The company should remember that the continuum of “plausibility” should not be confined or constrained to the outcomes and events exhibited by historic experience.

5. Companies should attempt to track experience for all assumptions that materially affect their risk profiles by collecting and maintaining the data required to conduct credible and meaningful studies of contract-holder behavior.

G. Additional Considerations and Requirements for Assumptions Applicable to Guaranteed Living Benefits

Experience for contracts without guaranteed living benefits may be of limited use in setting a lapse assumption for contracts with in-the-money or at-the-money guaranteed living benefits. Such experience may only be used if it is appropriate (e.g., lapse experience on contracts without a living benefit may have relevance to the early durations of contracts with living benefits) and relevant to the business.

### Section 12: Specific Guidance and Requirements for Setting Prudent Estimate Mortality Assumptions

A. Overview

1. Intent

The guidance and requirements in this section apply for setting prudent estimate mortality assumptions when determining the Stochastic reserve (whether using projections or the Alternative Methodology). The intent is for prudent estimate mortality assumptions to be based on facts, circumstances and appropriate actuarial practice, with only a limited role for unsupported actuarial judgment. (Where more than one approach to appropriate actuarial practice exists, the actuary should select the practice that the actuary deems most appropriate under the circumstances.)

2. Description

Prudent estimate mortality assumptions are determined by first developing expected mortality curves based on either available experience or published tables. Where necessary, margins are applied to the experience to reflect data uncertainty. The expected mortality curves are then adjusted based on the credibility of the experience used to determine the expected mortality curve. Section 12.B addresses guidance and requirements for determining expected mortality curves, and Section 12.C addresses guidance and requirements for adjusting the expected mortality curves to determine prudent estimate mortality.

Finally, the credibility-adjusted tables shall be adjusted for mortality improvement (where such adjustment is permitted or required) using the guidance and requirements in Section 12.D.

3. Business Segments

For purposes of setting prudent estimate mortality assumptions, the products falling under the scope of these requirements shall be grouped into business segments with different mortality assumptions. The grouping should generally follow the pricing, marketing, management and/or reinsurance programs of the company.

4. Margin for Data Uncertainty

The expected mortality curves that are determined in Section 12.B may need to include a margin for data uncertainty. The margin could be in the form of an increase or a decrease in mortality, depending on the business segment under consideration. The margin shall be applied in a direction (i.e., increase or decrease in mortality) that results in a higher reserve. A sensitivity test may be needed to determine the appropriate direction of the provision for uncertainty to mortality. The test could be a prior year mortality sensitivity analysis of the business segment or an examination of current representative cells of the segment.

For purposes of this section, if mortality must be increased (decreased) to provide for uncertainty, the business segment is referred to as a plus (minus) segment.

It may be necessary, because of a change in the mortality risk profile of the segment, to reclassify a business segment from a plus (minus) segment to a minus (plus) segment to the extent compliance with this section requires such a reclassification.

B. Determination of Expected Mortality Curves

1. Experience Data

In determining expected mortality curves, the company shall use actual experience data directly applicable to the business segment (i.e., direct data) if it is available. In the absence of direct data, the company should then look to use data from a segment that is similar to the business segment (i.e., other than direct experience). See Section 12.B.2. for additional considerations. Finally, if there is no data, the company shall use the applicable table, as required in Section 12.B.3.

2. Data Other Than Direct Experience

Adjustments shall be applied to the data to reflect differences between the business segments, and margins shall be applied to the adjusted expected mortality curves to reflect the data uncertainty associated with using data from a similar but not identical business segment.

To the extent the mortality of a business segment is reinsured, any mortality charges that are consistent with the company’s own pricing and applicable to a substantial portion of the mortality risk also may be a reasonable starting point for the determination of the company’s expected mortality curves.

3. No Data Requirements

When little or no experience or information is available on a business segment, the company shall use expected mortality curves that would produce expected deaths no less than using 100% of the 1994 Variable Annuity MGDB Mortality Table for a plus segment and expected deaths no greater than 100% of the 2012 IAM Basic Mortality Table for a minus segment. If mortality experience on the business segment is expected to be atypical (e.g., demographics of target markets are known to have higher [lower] mortality than typical), these “no data” mortality requirements may not be adequate.

4. Additional Considerations Involving Data

The following considerations shall apply to mortality data specific to the business segment for which assumptions are being determined (i.e., direct data discussed in Section 12.B.1 or other than direct data discussed in Section 12.B.2).

a. Underreporting of Deaths

Mortality data shall be examined for possible underreporting of deaths. Adjustments shall be made to the data if there is any evidence of underreporting. Alternatively, exposure by lives or amounts on contracts for which death benefits were in the money may be used to determine expected mortality curves. Underreporting on such exposures should be minimal; however, this reduced subset of data will have less credibility.

b. Experience by Contract Duration

Experience of a plus segment shall be examined to determine if mortality by contract duration increases materially due to selection at issue. In the absence of information, the actuary shall assume that expected mortality will increase by contract duration for an appropriate select period. As an alternative, if the actuary determines that mortality is affected by selection, the actuary could apply margins to the expected mortality in such a way that the actual mortality modeled does not depend on contract duration.

c. Modification and Relevance of Data

Even for a large company, the quantity of life exposures and deaths are such that a significant amount of smoothing may be required to determine expected mortality curves from mortality experience. Expected mortality curves, when applied to the recent historic exposures (e.g., three to seven years), should not result in an estimate of aggregate number of deaths less (greater) than the actual number deaths during the exposure period for plus (minus) segments.

In determining expected mortality curves (and the credibility of the underlying data), older data may no longer be relevant. The “age” of the experience data used to determine expected mortality curves should be documented.

d. Other Considerations

In determining expected mortality curves, consideration should be given to factors that include, but are not limited to, trends in mortality experience, trends in exposure, volatility in year-to-year A/E mortality ratios, mortality by lives relative to mortality by amounts, changes in the mix of business and product features that could lead to mortality selection.

C. Adjustment for Credibility to Determine Prudent Estimate Mortality

1. Adjustment for Credibility

The expected mortality curves determined in Section 12.B shall be adjusted based on the credibility of the experience used to determine the curves in order to arrive at prudent estimate mortality. The adjustment for credibility shall result in blending the expected mortality curves with a mortality table consistent with a statutory valuation mortality table. For a plus segment, the table shall be consistent with 100% of the 1994 Variable Annuity MGDB Table. For a minus segment, the table shall be consistent with 100% of the 2012 IAM Basic Mortality Table. The approach used to adjust the curves shall suitably account for credibility.

**Guidance Note:** For example, when credibility is zero, an appropriate approach should result in a mortality assumption consistent with 100% of the statutory valuation mortality table used in the blending.

2. Adjustment of Statutory Valuation Mortality for Improvement

For purposes of the adjustment for credibility, the statutory valuation mortality table for a plus segment may be and the statutory valuation mortality table for a minus segment must be adjusted for mortality improvement. Such adjustment shall reflect applicable published industrywide experience from the effective date of the respective statutory valuation mortality table to the experience weighted average date underlying the data used to develop the expected mortality curves (discussed in Section 12.B).

3. Credibility Procedure

The credibility procedure used shall:

a. Produce results that are reasonable in the professional judgment of the company.

b. Not tend to bias the results in any material way.

c. Be practical to implement.

d. Give consideration to the need to balance responsiveness and stability.

e. Take into account not only the level of aggregate claims but the shape of the mortality curve.

f. Contain criteria for full credibility and partial credibility that have a sound statistical basis and be appropriately applied.

4. Further Adjustment of the Credibility-Adjusted Table for Mortality Improvement

The credibility-adjusted table used for plus segments may be and the credibility adjusted date used for minus segments must be adjusted for applicable published industrywide experience from the experience weighted average date underlying the company experience used in the credibility process to the valuation date.

Any adjustment for mortality improvement beyond the valuation date is discussed in Section 12.D.

D. Future Mortality Improvement

The mortality assumption resulting from the requirements of Section 12.C shall be adjusted for mortality improvements beyond the valuation date if such an adjustment would serve to increase the resulting stochastic reserve. If such an adjustment would reduce the Stochastic reserve, such assumptions are permitted, but not required. In either case, the assumption must be based on current relevant data with a margin for uncertainty (increasing assumed rates of improvement if that results in a higher reserve or reducing them otherwise).